

# Pelagic active hunters

As mentioned in this research before, the definition of active hunters is described as predators with high mobility to locate and capture prey. This article specifies to only the pelagic active hunters within the North Sea and Wadden Sea including species such as herring (*Clupea harengus*), mackerel (*Scomber scombrus*), blue whiting (*Micromesistius poutassou*) and other pelagic active hunters. This article provides information about the intermediate trophic levels of which the species feed on zooplankton and phytoplankton and are main prey to the top-predators of the North Sea and Wadden Sea. In other words, pelagic active hunters transfer the biomass of the lower trophic levels (plankton) to the higher trophic levels (larger fish, marine mammals and birds).



## History/population trends

According to Fauchald et al. (2011), marine pelagic ecosystems are often characterized by highly diverse upper and lower trophic levels and a less diverse intermediate level, a so-called “waspy-waist” ecosystem. The intermediate level, consisting of mainly forage fish species, influences the lower trophic levels by top-down and upper trophic levels by bottom-up control (Fauchald et al., 2011). Forage fish species are small or intermediate-sized pelagic species that feed on zooplankton and phytoplankton and are the primary food source for many marine predators, including mammals, seabirds and larger fish (Pikitch et al., 2012). Around 1993, the productivity of North Sea forage fish decreased significantly due to a decline in the presence of the calanoid copepod *Calanus finmarchicus*, which is positively correlated with forage fish (Clausen et al., 2017). According to Clausen et al. (2017), the decrease of productivity was best visible in the average length and weight of the individuals. However, Shepard et al. (2014) found that the forage fish biomass in the North Sea has remained relatively stable from 1983 to 2012. This stability may indicate that any productivity changes among the forage fish stocks have been effectively counteracted by appropriate management action in commercial fisheries (Dickey-Collas et al., 2014). However, as a consequence of the current global warming situation, rising seawater temperatures may force several forage fish species to migrate north to find new habitats, since areas with lower temperatures are more conducive to their survival and reproduction (Zeng, 2020). This possibly leads to empty fishing nets and no economical profit for small fisheries in the North Sea (Zeng, 2020).

## North Sea vs. Wadden Sea

The diet of pelagic forage fish largely consists of mesozooplankton, with *Calanus finmarchicus* being particularly important for herring and mackerel (Mousing et al., 2023). Both herring (*Clupea harengus*) and sprat (*Sprattus sprattus*) spawn in the Wadden Sea and migrate as juveniles towards the deeper North Sea to reach adulthood (Dänhardt & Becker, 2011). Large highly migratory predators, being the Atlantic bluefin tuna (*Thunnus thynnus*) for example, can have major impacts on local marine ecosystems (Mariani et al., 2017). This top-predator has returned in the North Sea after being absent for half-century, since the 1960s, and the effects of their return are instantly visible in the fish community, especially in fish mortality of herring and mackerel, since those species are main prey to *T. thynnus* (Mariani et al., 2017).

## Sources

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